FATES OF THE BLOOM-FORMING FILAMENTOUS CYANOBACTERIA IN THE FACE OF PROGNOSED CLIMATE CHANGE

The Earth's climate is changing and most noticeable effects of this phenomenon include the increase of temperature and CO_2 concentration in the atmosphere. According to predicted climate change scenarios, global mean temperature is expected to increase in the range of 3–4 °C by the end of the century, at which atmospheric CO_2 concentration will reach the value of 540–970 ppm (*parts per million*) from the present 407–414 ppm *(current global mean CO_2 concentration based on records from NOAA Global Monitoring laboratory*). Such profound changes will have considerable consequences for both physical, chemical and biological characteristics of water (e.g. *increase water acidification, hypoxia*), thereby affecting aquatic residents (e.g. *tightening of competitive interactions*), and consequently the functioning of whole ecosystems (e.g. *biodiversity loss*).

Among potential aquatic winners that might excellently come out of the climate change debacle, cyanobacteria are most frequently indicated due to their long evolutionary history (*around 3.5 billion years*) that has been instrumental in gaining by them high resistance to long-term climatic changes as well as current anthropogenic and climatic alterations of aquatic ecosystems. Massive occurrence of cyanobacteria is observed more and more frequently in various types of aquatic ecosystems and poses a great threat to aquatic organisms, particularly filter-feeding cladocerans which constitute key elements of aquatic food-web and play important role in trophic cascades and ecosystem productivity regulation. Although bloom-forming cyanobacteria and their harmful effects on filter-feeding cladocerans are intensively studied around the world, little is known about the joint impact of carbon dioxide elevation and progressive warming – most notable consequences of global climate change – on the performance of these producers and their interaction with consumers. The vast majority of studies have only been focused on a single variable (*either CO_2 or temperature*) excluding the interactive effect between them. However, values of these climatic variables increase simultaneously rather than independently of each other.

The aim of this project is to determine the impact of combined CO_2 and temperature elevation on fate of bloom-forming cyanobacteria. In particular, we would like to understand and explain (**1**) *how bloom-forming filamentous cyanobacteria cope with progressive CO_2 and temperature elevation* (**2**) *whether long-term CO_2 and temperature elevation will lead to a permanent dominance of thermophilic and exotic cyanobacteria species or adaptation of species native to temperate zone* (**3**) *how CO_2 and temperature elevation affects the toxicity of cyanobacteria and if these conditions can lead to the dominance of toxic genotypes over non-toxic ones*, and (**4**) *whether the impact of CO_2 and temperature elevation on cyanobacteria induce cascade effect observable in the functioning of zooplankton*.

To find answers the above questions, we will follow the "*climatic*" response of wide range of commonly bloom-forming filamentous cyanobacteria. Among these genera are species whose ecology is little known and whose taxonomic position is still unclear. There are also highly invasive species of tropical origin, high thermal tolerance, high invasiveness as well as wide and still-expanding distribution in temperate zone. Performance of cyanobacteria will be investigated at molecular, cellular, population, and community level. To assess the effects of CO_2 and temperature elevation on the edibility of cyanobacterial trichomes to cladocerans, we will apply experimental evolution approach. This will rely on comparison of the filtering efficiency, antioxidant enzyme activities, and oxidative stress damage to proteins in *Daphnia* exposed to lines of cyanobacteria experienced or not with CO_2 and temperature elevation.

Owing realization of the proposed research programme, we will give realistic global perspective on the status of a wide range of bloom-forming cyanobacteria in the future climate, their threat to aquatic biota, ecosystem functioning, and drinking water resources. Obtained results will be confronted to the prognosed pessimistic scenario predicting progressive intensification of cyanobacterial blooms frequency and persistence, increase of their toxicity and harmfulness to filter-feeding key zooplankters.